DOTY RAVINE

A. Water Quality Data

1. Lincoln High School Water Quality Monitoring: Mark Fowler and Lee Beckman provided this data from the Lincoln High School sampling program, which was jointly funded by NID, Placer County, and the City of Lincoln. While data for Doty Ravine are limited, three parameters are of concern from a stream ecology standpoint. First, the pH readings from the Garcia Property are relatively high and correlate with a trend of unusually high pH values in the Western Placer County streams, particularly in the fall. Second, the dissolved oxygen concentrations reported show supersaturated levels of approximately 150%, which is unusual for lower gradient streams. This trend is also noted in other local streams. Third, the concentrations of nitrate reported are high for a fall reading and could indicate eutrophication of the stream, particularly during the summer months. Without data on orthophospate for comparison, it is impossible to determine if nitrates are limiting biostimulation of algal growth and potentially causing diurnal dissolved oxygen fluctuations during the nighttime hours. Excessive algal growth has been observed in other local streams. The limited quantity of water quality data available for Doty Ravine does not allow any definite conclusions to be drawn. **Source: Lincoln High School Water Quality Monitoring, unpublished data.**

Table 1. Doty Ravine Water Quality Data 2001-2002

Parameter	Garcia Property	Garcia Property	Weygant Property	Unnamed NID canal
Date	10/7/2001	10/14/2001	10/27/2002	5/6/2002
Time	1146	0945	--	0620
Air Temperature (^{O}F)	--	--	68	51
Water Temperature (^{O}F)	64	60	56	56
Weather	Clear	Clear	Clear	Clear
Stream Flow (cfs)	2	0.7	1.4	--
pH	8.1	8.7	7.3	8.1
Dissolved Oxygen (mg/L)	16.5	14.1	16.5	16.5
Electrical Conductivity (µs/cm)	106.2	122.1	170.2	61.1
Color (color units)	2	0	5	61
Nitrates (mg/L)	1.8	1.4	0.8	1.0
Chlorides (mg/L)	0.03	0.04	0.00	0.10
Total Coliform (MPN/100ml)	2400	240	43	240
Fecal Coliform (MPN/100ml)	150	240	43	240

Source: Lincoln High School Water Quality Monitoring, unpublished data.

2. Auburn Ravine/Coon Creek Ecosystem Restoration Plan: In the background information for this Plan, there is reference to a one-time sampling conducted by CH2MHill on 2/1/1996. The parameters apparently measured were dissolved oxygen, pH, turbidity, and water temperature, but no data are provided. **Source: unpublished data, Bob Coats, Hydroikos Consulting, San Rafael, CA.**

B. Water Temperature Data

Water temperature data from various one-time fish sampling projects conducted by the CDFG are presented below, most of the data from monitoring conducted by Bailey Environmental, which includes hourly readings. Due to limitations in the statistical package, only 3,000 temperature data points can be displayed in a single time series plot. Since daily maximum, minimum, and/or mean temperatures individually are of little value, I have chosen to plot all data points. Therefore, I have split the year into time periods that roughly correspond to:

Fall-early winter: September though December; primary fall-run chinook salmon spawning period is November-December.
Winter-spring: January though April; fall-run chinook salmon incubation and rearing and steelhead spawning, incubation, and rearing.
Late spring-summer: May to September; summer rearing for steelhead juveniles.

Data plots for these time periods are presented below to allow the reader to assess the potential of Doty Ravine to support chinook salmon and/or steelhead trout spawning and rearing. A variety of local data and literature was reviewed, to characterize the general effects of water temperature on various life history stages for both chinook salmon and steelhead trout. There is fairly substantial variation in temperature effects noted for most life history stages, and both chinook salmon and steelhead are have a highly adaptable physiology and ability to seek thermal refuge during part of the day which may allow them to tolerate and/or avoid lethal temperatures. Some of the literature sources cite criteria from others and some of the data are based on fish captures with water temperature taken concurrently. Two tables with data and reference are included in Appendix A of this report. Based on this review, the following criteria have been used to indicate what life history stages a particular stream may support at any given time:

Chinook Salmon	**^{O}C**	**Steelhead Trout**	**^{O}C**
Egg and fry development	14.4 (58 ^{O}F)	Egg and fry development	14.4 (58 ^{O}F)
Juvenile rearing	21.1 (70 ^{O}F)	Juvenile rearing	22.2 (72 ^{O}F)
Adult migration	21.7 (71 ^{O}F)	Adult migration and holding	22.2 (72 ^{O}F)

Reference lines for 14.4 ^{O}C and 22.2 ^{O}C have been provided on Figures 1-8 below to roughly represent the water temperatures suitable for salmonid spawning migration, egg and fry development, and juvenile rearing.

1. **Spring 1965 Fall-Run Chinook Salmon Juvenile Emigration Survey by Eric Gerstung:** The following water temperature data were reported in this survey. **Source: Hand written draft of May 25, 1965 memorandum in CDFG, Region 2 files.**

Date	Time	Temp. (°F)	Location
2/24/65	1145	51	100 yards downstream of Gladding Road crossing
2/25/65	1125	51	100 yards downstream of Gladding Road crossing
2/27/65	1420	56	100 yards downstream of Gladding Road crossing
3/2/65	1200	54	100 yards downstream of Gladding Road crossing
3/3/65	1300	52	100 yards downstream of Gladding Road crossing
3/4/65	1230	54	100 yards downstream of Gladding Road crossing
3/8/65	1040	54	100 yards downstream of Gladding Road crossing
3/11/65	1300	--	100 yards downstream of Gladding Road crossing
3/12/65	1130	--	100 yards downstream of Gladding Road crossing
3/15/65	1240	58	100 yards downstream of Gladding Road crossing
3/17/65	1100	55	100 yards downstream of Gladding Road crossing

Source: Hand written draft of May25, 1965 memorandum in CDFG, Region 2 files.

2. **1984 Seining and Electrofishing for Native Brood Year 1983 Fall-Run Chinook Salmon. Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

Date	Time	Water Temp. (°F)	Location
2/28/84	1330	53	McCourtney Road
2/28/84	1330	53	Garden Bar Road
3/27/84	1130	56	McCourtney Road
5/2/84	---	53	McCourtney Road

Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

3. **Teichert Aggregate Project Area:** A water temperature of 61 °F was measured in Doty Ravine, upstream of Coon Creek, at 1100 hours on April 24, 1995. **Source: FEIR Teichert Aggregate Facility, County of Placer, December 2001.**

4. **Water Temperature Information from Bailey Environmental September 2001 to August 2003:** Figures 1-6 are for a single temperature monitoring station located approximately 200 yards upstream of the Crosby Herold Bridge crossing on the former property of the Garcia family. This station was discontinued in June 2003 because a new owner installed a new fence making access more difficult. This monitoring location was moved approximately 1,000 ft. upstream to the Munson property in June 2003. Beginning in June 2003, two additional monitoring locations were established at the Wise and Goldhill Road crossings. Data for June-August 2003 are presented in Figures 7 (Wise Road) and 8 (Goldhill Road). **Source: Bailey Environmental, unpublished data.**

Figure 1. Water temperature time series for Doty Ravine at the Garcia property, September through December 2001. Data indicate that successful fall-run chinook salmon spawning could have begun in late October/early November in 2001 and that conditions were suitable for juvenile rearing.

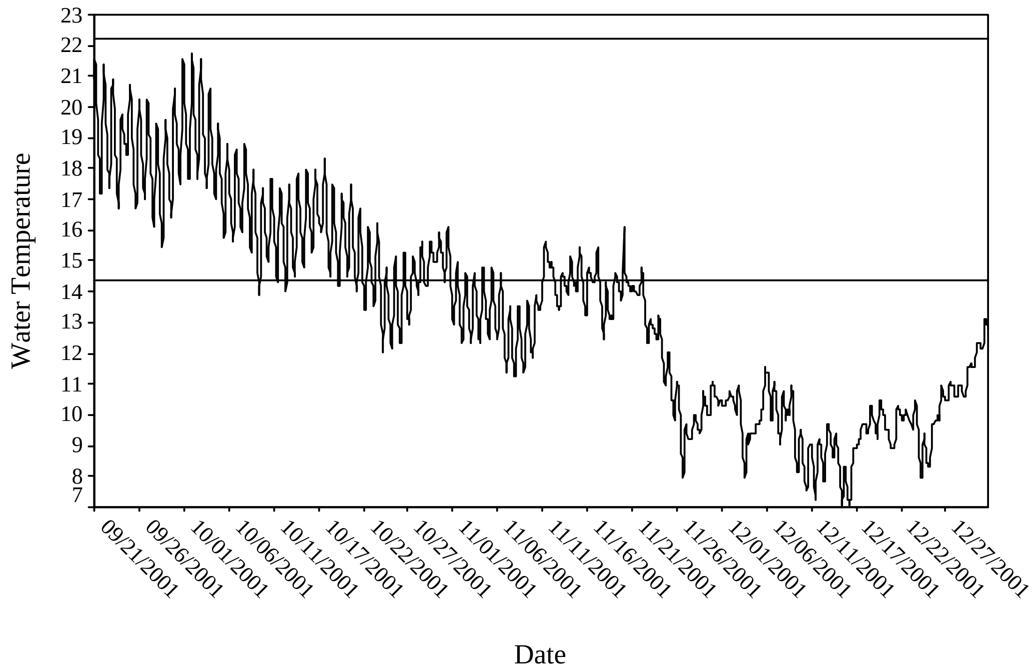


Figure 2. Water temperature time series for Doty Ravine at the Garcia property, January through April 2002. Temperatures are suitable for egg incubation and juvenile rearing.

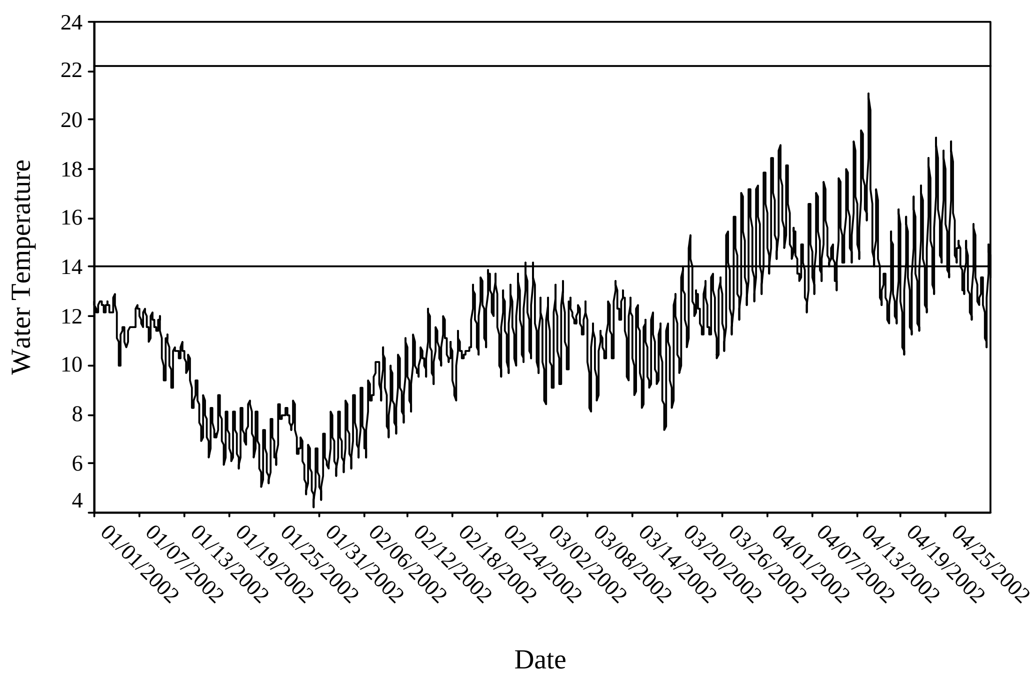


Figure 3. Water temperature time series for Doty Ravine at the Garcia property, May through August 2002. Temperatures are suitable for juvenile rearing, where data exists. However, the critical summer period has no data.

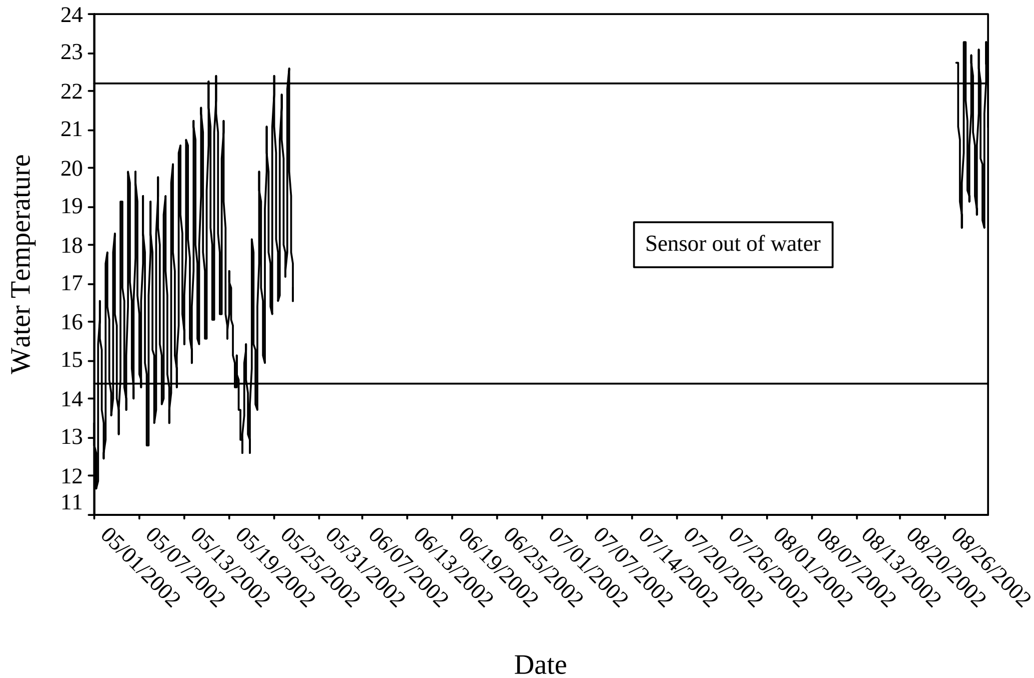


Figure 4. Water temperature time series for Doty Ravine at the Garcia property, September through December 2002. Data indicate that successful fall-run chinook salmon spawning could have begun in late October/early November in 2001 and that conditions were suitable for juvenile rearing.

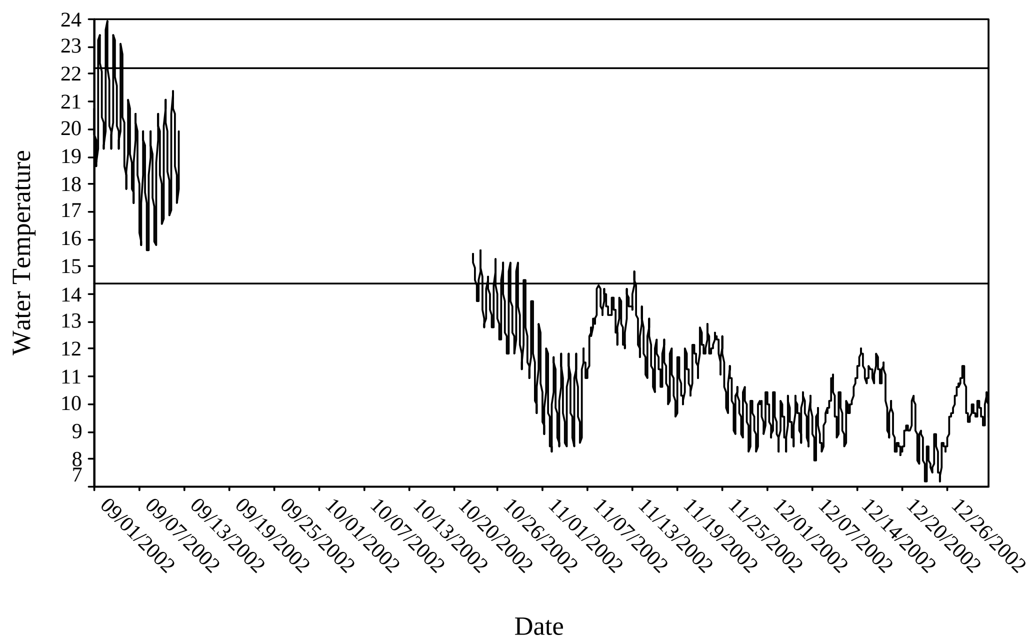


Figure 5. Water temperature time series for Doty Ravine at the Garcia property, January through April 2003. Temperatures are suitable for egg incubation and juvenile rearing.

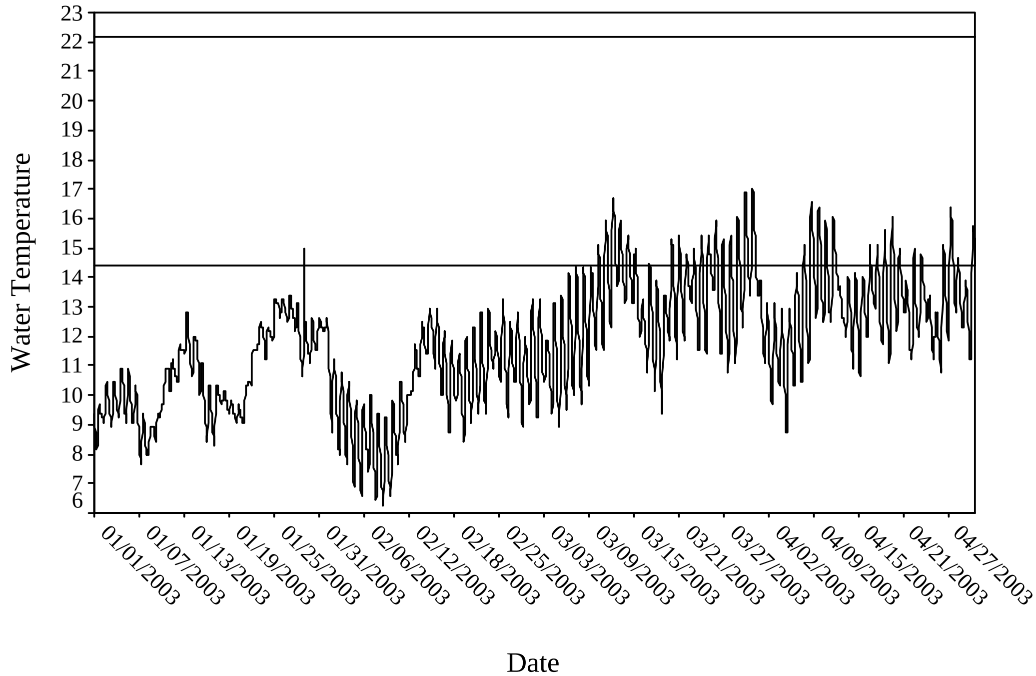


Figure 6. Water temperature time series for Doty Ravine at the Garcia property, May through August 5, 2003. Temperatures are suitable for juvenile rearing.

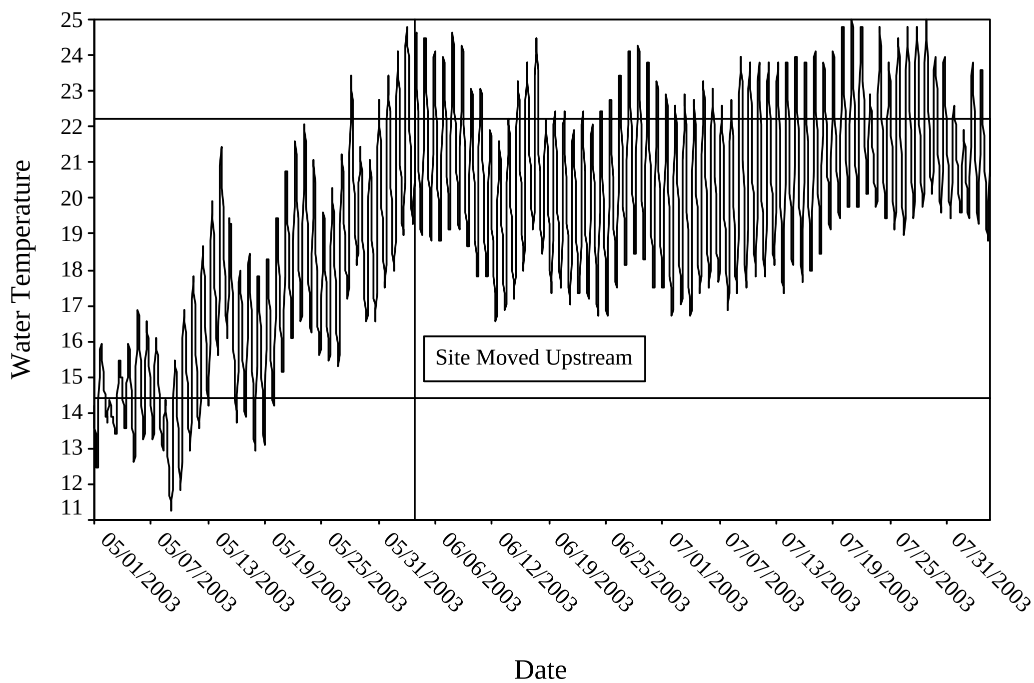


Figure 7. Water temperature time series for Doty Ravine at Wise Road, June 4 through August 5, 2003. Temperatures are suitable for juvenile rearing.

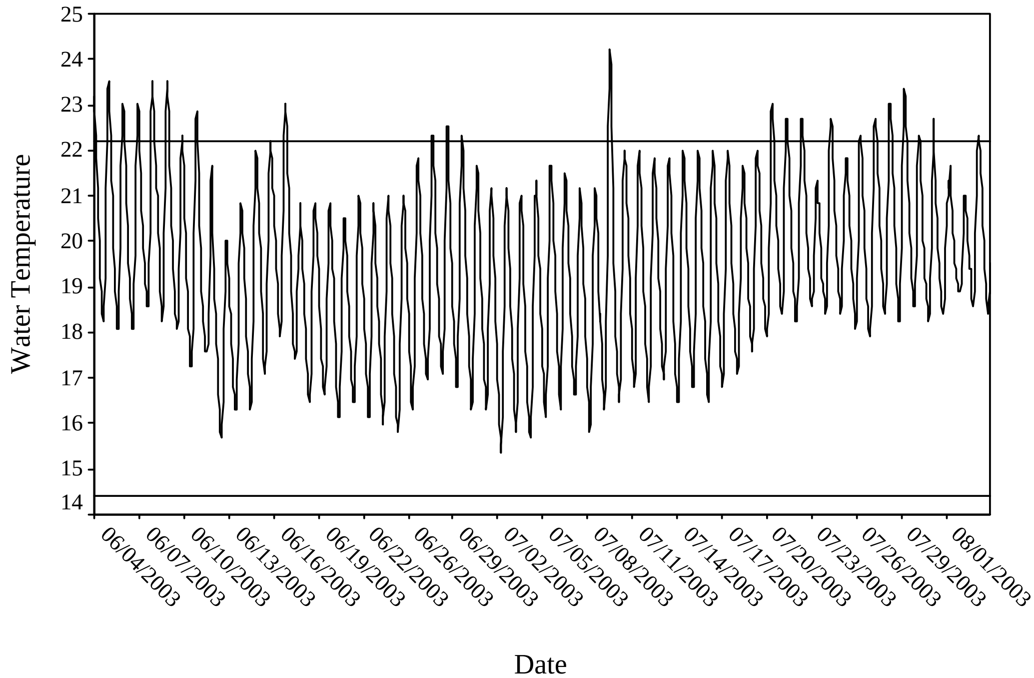
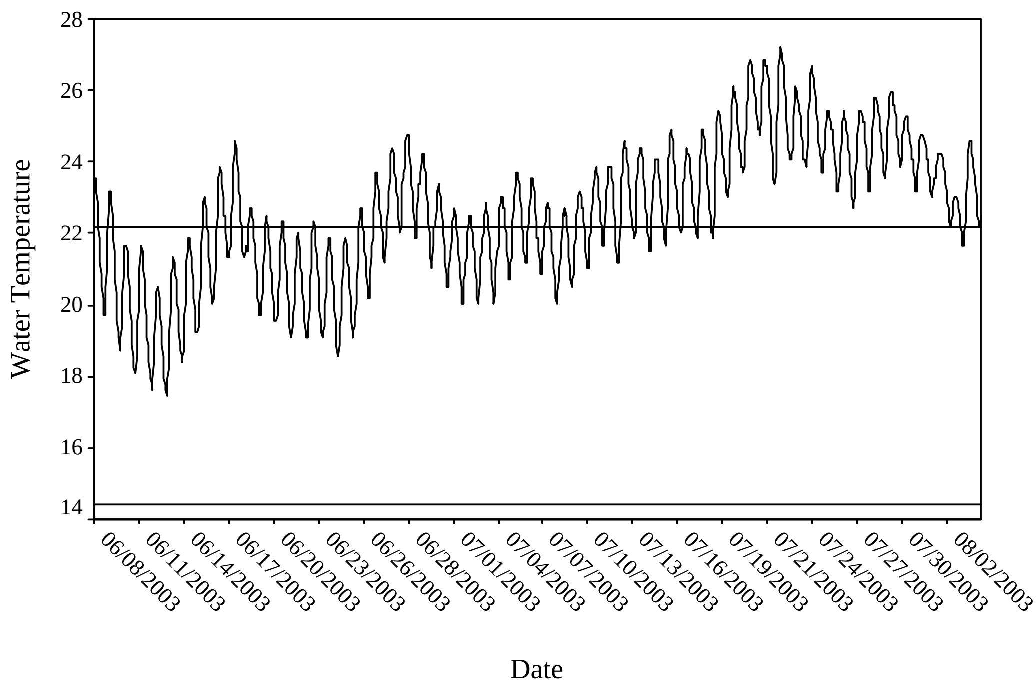


Figure 8. Water temperature time series for Doty Ravine at Goldhill Road, June 4 through August 5, 2003. Temperatures are marginally suitable for juvenile rearing.



C. Benthic Invertebrate Data

Limited benthic macroinvertebrate data (see Appendix Doty Ravine 1 for the complete data set) have been collected from Doty Ravine at the Garcia Property, just upstream of Crosby Herold Road. Samples were collected in December 2000, October 2001, and some unknown time in 2002 (Mark Fowler indicated that the 2002 samples have been collected, but analysis was not complete). The data are limited in usefulness for two reasons. First, samples were collected with equipment that does not readily collect all taxa present in the stream. Second, during the initial sorting, generally less than 100 individuals are selected for taxonomic identification. This limited sample size raises concerns regarding the representativeness of the data. However, the data do indicate that organisms that are moderately too highly tolerant of water quality impairment dominate the invertebrate community. A combination of flow fluctuations, water quality, and the amount of sediment in the stream channel probably contributes to this general lack of diversity and tendency towards species that are pollution tolerant. **Source: Benthic Macroinvertebrates sampled from Placer County Streams. Prepared for the Auburn Ravine Group by BioAssessment Services, Folsom, CA. December 2002.**

D. Physical Habitat Data

1. 1964 Chinook Salmon Spawning Gravel Survey [This information is not fully documented in CDFG files, and was based on an unsigned author note in CDFG, Region 2 files. I assume that this data is from Eric Gerstung's 1964 adult fall-run chinook salmon spawning surveys]. The following information was reported.

Section	Stream Miles	Distance Surveyed	Spawner Capacity/mi.	Salmon Use [Observed?]	Section Capacity
Coon Creek to McCourtney Rd.	4.0	--	50	0	1 mile w/ gravel = 50 fish
McCourtney Rd. to Fruitvale [Crosby Herold]	1.5	0.2	100	0	150
Fruitvale [Crosby Herold] to Garden Bar Rd.	1.0	0.3	100	0	100
Garden Bar Rd. to Wise Powerhouse Rd. [Wise Rd.]	1.0	--	50	0	50
Wise Powerhouse Rd. [Wise Rd.] to Goldhill Rd.	1.7	--	50	0	50

Source: Unsigned author note in CDFG, Region 2 files.

2. 2003 Placer County Spawning Gravel Survey: During the summer of 2003, Placer County funded a survey to examine steelhead trout spawning gravels in this drainage (as well as others). No data are currently available from this effort.

3. 2003 Placer County Stream Videography Project: On March 12, 2003 Doty Ravine was videotaped from the air from the confluence with Coon Creek upstream to a point above Wise Road. Review of the video footage shows that the riparian area of the stream varies from very poor quality to very high quality, depending on the location. Generally the degraded areas of riparian are in the downstream locations. Also, this footage revealed extensive bank erosion that is contributing to the sediment load in the stream. The proportion of the excessive sediment load attributable to bank erosion versus decomposition of underlying rock formations is unknown. Sediment contributions from land disturbing activities and roadways are also unknown. **Source: 2003 Placer County Stream Videography Project, unpublished data.**

E. Fishery Resource Data

1. Documented Fish Species Present in the Stream

Fall chinook salmon (native)
Fall chinook salmon (introduced – Feather River Fish Hatchery)
Spring-run chinook salmon (introduced – Feather River Fish Hatchery)
Sacramento pikeminnow (formerly known as Sacramento squawfish)
Sacramento sucker
Brown trout
Catfish (species undocumented)
Rainbow trout/steelhead
Tule perch
Source: California Department of Fish and Game, Region 2 files

2. Fish Stocking Records

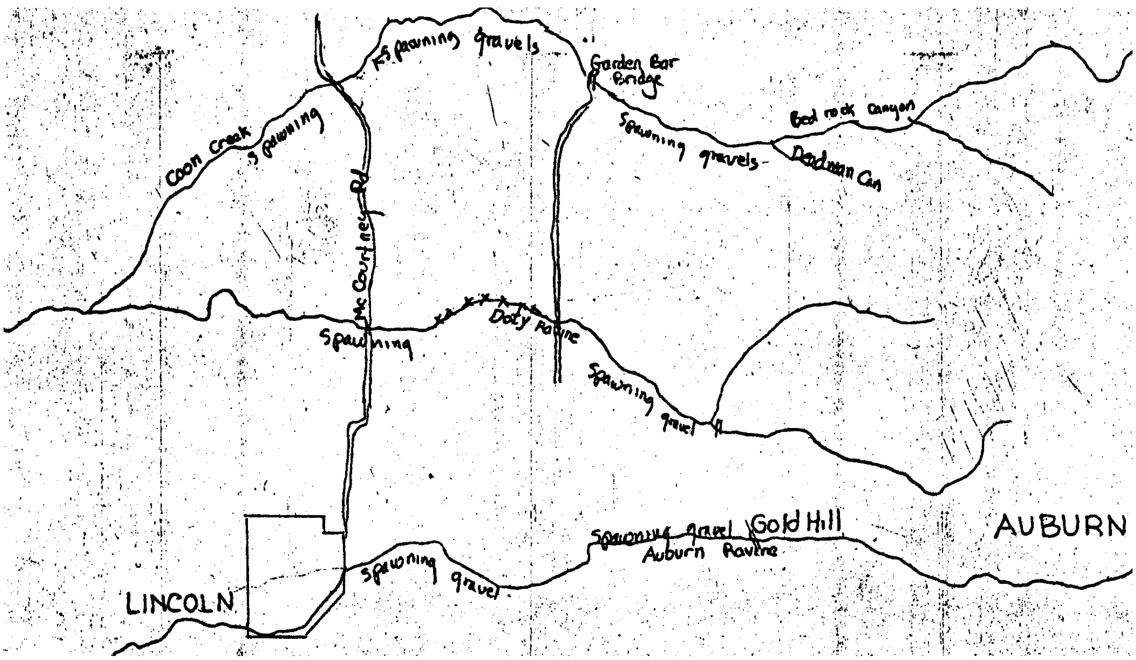
The following stocking records for chinook salmon were found in CDFG's Region 2 files:

Species	Origin	Date	Size (No./lb)	Mean Length*	Number Stocked	Location
Fall chinook salmon	Feather R. FH	1/27/87 or 1/28/87	704	42 mm	49,280	Garden Bar Road
Fall chinook salmon	Feather R. FH	1/31/86 or 2/3/86	480	48 mm	24,000	Garden Bar Road
Spring-run chinook salmon	Feather R. FH	2/20/85	344	54 mm	77,400	Gladding Road

*Length estimates from Fish Hatchery Management, Fish and Wildlife Service, 1992.

3. **Adult Spawning Timing, Distribution, and Population Estimates**

- **1964 Fall-run Chinook Salmon Spawning Survey by Eric Gerstung:** Gerstung noted that fish moved upstream after rains on October 30, 1964. Spawning was 80% complete by November 23, 1964. Fish and Game wardens reported that many fish had been poached before the survey started [this statement is probably not particularly relevant to Doty Ravine because of the low estimated adult spawning run of 10 fish]. Gerstung notes that the spawning runs were similar to 1963, but no data on the 1963 runs were found in the files examined. Gerstung surveyed 5,000 linear feet of stream, on November 23, 1964 near the Garden Bar Road Bridge [See figure below] and found 1 live fish and 1 carcass. Small x's indicate salmon spawning survey areas and other text indicates areas where spawning gravels were present. The water was reported clear, with flow estimated at 15 cfs. **Source: May 25, 1965 memorandum in CDFG, Region 2 files.**



- **December 6, 1985 Spawning Survey:** Three locations on Doty Ravine were surveyed for fall-run chinook salmon on 12/6/85. No specific locations were documented. No fish or redds were observed. Flow was estimated at 10 cfs. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

- **Fall 1958 Anecdotal Report:** Unidentified rancher reported fall-run chinook salmon in Doty Ravine to an unknown Fish and Game employee in March of 1959. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

- **Warden's Patrol Report:** Fish and Game Warden Wayne Caldwell reported seeing 37 [fall-run?] chinook salmon in Doty Ravine prior to November 10th of an unidentified year. **This observation is probably based on a 1979 warden's report, which has Warden Caldwell's signature.**

4. **Juvenile Distribution and Sampling Data**

- **March 3, 1959 Electrofishing Survey:** No specific location is reported. Unknown author reports small rainbow trout population. The following fish species were captured by electrofishing an unknown length of stream:
  2 rainbow trout (8-10 inches in length)
  "few" brown trout
  suckers (up to 24 inches in length)
  catfish
  Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

- **Spring 1965 Fall-run Chinook Juvenile Emigration Survey by Eric Gerstung:** Gerstung began trapping downstream migrant fall-run chinook juveniles on 2/24/1965 and continued through 3/17/1965. Trap location is reported as T 13 N, R 6 E, S 34, NW1/4 of NE1/4; approximately 100 yards downstream of "Gladding Clay Pit Road" on the left bank [Review of the topographic map indicates that this site was located approximately 100 yards downstream of the Gladding Road crossing over Doty Ravine. Sampling was with a "riffle" trap or perforated plate trap, which covered 7ft of the 22ft. width of the channel. The trap fished a total of 503.5 hours and captured 2 juvenile chinook salmon. Water clarity was recorded as clear for each day [11 days] the traps were checked over this time period. Water temperatures were recorded at the time the traps were checked and are reported above, in the water temperature section of this report. Gerstung notes: "Most salmon are believed to have remained in the stream above the traps during the sampling period" [General statement regarding all of the streams surveyed}. No other fish species catch composition data is reported. **Source: May 25, 1965 memorandum in CDFG, Region 2 files, handwritten draft of May 25, 1965 memo, and other handwritten notes.**

- **1984 Seining and Electrofishing for Native Brood Year 1983 Fall-run Chinook Salmon:** Water temperatures for this sampling effort are reported above. The following sampling results are reported for this sampling effort. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

Date	Effort	No. Chinook	Length Mode (mm)	Length Range (mm)	Other Fish Species	Location
2/28/84	2 seine hauls	4	40	40-44	1 – tule perch 3-squawfish*	McCourtney Road
2/28/84	2 seine hauls	4		35-44		Garden Bar Road
3/27/84	100-200' electrofish.	0				McCourtney Road
5/2/84	2 seine	1		97	3-squawfish*	McCourtney

hauls		1 – sucker	Road

***** Sacramento squawfish are now known as Sacramento pikeminnow.
Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

F. Fish Passage or Screening Data

This section of the report documents known fish passage or screening needs. Immediately below are brief discussions of the two man structures that may be fish passage impediments or barriers under certain flows or operational conditions. Following these assessments is a discussion of water flows and beaver activities, which may preclude anadromous fish from reaching these two structures under adverse flow conditions.

1. Doty Ravine, NID Doty Ravine South Diversion Structure (Assessment by Randy Bailey, based on an on-site visit and discussions with NID staff)

This structure was not included in the evaluation of diversion structures during the completion of the Auburn Ravine/Coon Creek Ecosystem Restoration Plan

- **Location:** This structure is located on Doty Ravine approximately ¼ to ½ mile downstream of Crosby Herold Road.

- **General Description:** This diversion is a U-shaped concrete structure with abutments and sidewalls approximately 6 feet high with a concrete bottom. An inlet into a canal is situated on the south bank of the channel and consists of concrete headworks with a trash rack. The bottom of the structure is relatively flat with an approximately 6-foot apron downstream of the flashboard location. Downstream of the apron, a boulder field approximately 20-30 feet long has been placed to stop water from scouring underneath and undermining the concrete apron. Flashboards are installed at the beginning of the irrigation season (about April 15 in most years) and removed at the end of the season (about mid-October). During the irrigation season, little flow is allowed downstream of this point.

- **Assessment:** Given the general season of operation, under moderate to high flows, this diversion structure does not present a problem for adult anadromous fish migrating upstream to spawn. Under lower flows (unquantified at this time) the boulder field immediately downstream of the apron would become a passage barrier for adults. However, under lower flows, it may be impossible for adults to even reach this location from downstream because of lack of water depth or other passage impediments such as beaver dams. Also, the headworks for the canal are unscreened and juveniles could be diverted into the canal.

  Since the water diversions at this site do not generally begin until mid-April it is possible that juveniles moving downstream of this location would be killed by high water temperatures in Coon Creek or the Eastside/Cross canals before they could reach the Sacramento River. However, insufficient water temperature monitoring data exists to reach a conclusion one way or another. In years of high runoff and/or a cool spring, it may be possible for juveniles to emigrate successfully. Also, during years of high late-spring runoff, the diversion would not be operated in mid-April. It is also important to note that actively emigrating smolts could easily transit the distance from this diversion site to Coon Creek in as little as one day. Fall-run chinook salmon have been documented spawning upstream of this location.

2. Doty Ravine, Garden Bar Road Culvert (adapted from the Auburn Ravine/Coon Creek Ecosystem Restoration Plan; analysis by James Buell, PhD)

- **Location:** The Garden Bar Road crossing of Doty Ravine

- **General Description:** The Garden Bar Road crossing of Doty Ravine consists of a masonry and fill road prism extending across the stream channel with a 12 ft diameter round culvert. The culvert is sloped at about 2% and is perched about 4 ft above the low flow water surface of a large scour hole immediately downstream of the road fill. This scour hole is used as a “swimming hole” by local residents, and extends about 100 ft downstream to a gravel tail bar. The active stream channel is well over 100 ft wide downstream of the scour hole and is depositional in nature. Bed materials are primarily sand and fine gravel, with gravel and cobbles in the thalwag. Banks are composed of fine materials and are erodible.

- **Assessment:** The perched nature of the culvert and its slope combine to make this crossing an effective adult anadromous fish migration barrier at all but flows high enough to backwater the culvert invert. The very wide control of the scour hole downstream indicates that backwatering would only be achieved under very high stream flows. Given the length and slope of the culvert, it is possible that some aggressive steelhead could negotiate this crossing under less-than-backwatering stream flows, but it is likely that most fish would not.

- **Priority for Attention:** High.

- **Alternative approaches:** Several alternatives are available for achieving good fish passage conditions under most stream flows at the Garden Bar Road crossing of Doty Ravine:

  (a) ***Culvert replacement with a bridge.*** This approach would involve removing most or all of the masonry and fill road prism across the Doty Ravine stream corridor and replacing it with a formal bridge structure. Advantages of this approach are good passage conditions under virtually all stream flows during which adult anadromous fish are migrating with little or no maintenance other than standard bridge maintenance. Disadvantages include very high cost and eventual disappearance of the “swimming hole.”

(b) ***Culvert replacement with an arch culvert.*** This approach is similar to the first alternative, except it would require less demolition of the existing road prism. The arch should be large enough to convey flood flows without foundation scour. A "natural" streambed bottom would be maintained, perhaps with some scour to large pavement materials (large cobbles, boulders), and concrete footings would be required to prevent undermining. Advantages of this approach include good passage conditions under the great majority of stream flows during which adult anadromous fish are migrating, with little or no maintenance other than standard arch culvert maintenance. Disadvantages include high cost and eventual disappearance of the "swimming hole".

(c) ***Culvert replacement with a larger elliptical culvert.*** This approach is similar to the second alternative, except it would not require concrete footings (although the culvert would still have to be sealed). Culvert size should be established through an engineering analysis, but would probably be about 16 ft on the vertical axis. The invert of the culvert should be submerged for its entire length under low flow conditions. Advantages of this approach include elimination of bed scour under the road crossing and good passage conditions under the great majority of stream flows during which adult anadromous fish are migrating with little or no maintenance other than standard culvert maintenance. Disadvantages include high cost and probably eventual reduction in size of the "swimming hole".

(d) ***Backwater culvert with a series of box weirs.*** This approach would involve construction of a series of low box weirs extending downstream from the mouth of the culvert. Dimensions of the series should be established by an engineering analysis, but the entire footprint may be on the order of 30 ft wide by 50 ft long (downstream direction). Each box weir should have three rectangular notches (approximately 24 in wide x 10 in deep) to concentrate flow at moderate stream discharge, one on each side and one in the downstream end. Notches should be staggered rather than aligned. The elevation of the invert of the notches upstream-most box weir should not be more than 1 ft below the elevation of the invert of the existing culvert. It is likely that three box weirs will be required, but it is possible that two will be sufficient. Advantages of this approach include good passage conditions under most stream flows during which adult anadromous fish are migrating with little or no maintenance and relatively modest cost. Disadvantages include potential reduction of conveyance capacity of the existing culvert and significant encroachment into the existing "swimming hole."

(e) ***Construct Alternative 4 using gabions.*** This approach is essentially identical to Alternative 4 except that gabions (rock-filled wire baskets) would be used to construct the box weirs. Advantages include those associated with Alternative 4 and lower cost. Disadvantages include periodic maintenance and repair and safety risk associated with sharp broken wires in an area actively used by children for water-oriented recreation.

(f) ***Backwater culvert with a series of low "V" weirs.*** This approach would involve construction of a series of low, shallow-angle "V" weirs across the entire Doty Ravine stream corridor and reinforcing (armoring) stream banks in the vicinity of each weir (possibly the entire project area). The angle of the "V" in each weir should be sufficient to concentrate flows near the center of the channel; however the series should be staggered off the channel centerline by about 8-10 ft. The elevation of the invert (center of the "V") of the upstream-most weir should be not more than 1 ft below the elevation of the invert of the culvert. It is likely that three weirs would be required. Advantages of this approach include good passage conditions under most flows during which adult anadromous fish are migrating with little or no maintenance and probably insignificant reduction in conveyance capacity of the existing culvert (an engineering analysis of this parameter should be performed, however). Disadvantages include significantly higher cost than the fourth alternative (see above), potential bank scour and very extensive "modification" of the "swimming hole".

- **Recommendation:** Perform hydraulic and cost analyses on the third and fourth alternatives, above (culvert replacement with elliptical culvert, submerged invert; series of notched box weirs). Select and implement the most cost-effective approach meeting appropriate engineering and conveyance criteria.

3. Water Flows

Fall and winter water flows are particularly important in Doty Ravine. Because water deliveries are curtailed, generally before fall-run chinook salmon attempt to migrate upstream to spawn, the depth of water in the channel can be insufficient to provide adult passage. Adult chinook salmon and steelhead need approximately 1± foot of water depth with some resting pools in order to migrate upstream. Transit time for adult fish from the Coon Creek confluence to upstream of Crosby Herold Road could routinely be accomplished in one day. However, adequate water depth is critical and should be taken into consideration concurrently with any fish passage projects for this drainage.

4. Beaver Dams

Beaver dams and beaver activity in general hinder adult anadromous fish passage in this watershed. During the stream videography project, six major beaver dams were documented from the air, between the confluence with Coon Creek and an area upstream of the Wise Road crossing on March 12, 2003. During the fall/winter of 2002/2003, major beaver dams were located within 100 feet of the Crosby Herold and Wise Road crossings. These dams remained in place and blocked adult fish passage for the entire spawning season for both fall-run chinook salmon and steelhead, with the possible exception of part of one day at the Crosby Herold Bridge. There may have been other passage problems related to beaver activity further downstream that would render the problems at upstream locations moot.

APPENDIX DOTY RAVINE 1

BENTHIC MACROINVERTEBRATE DATA
COLLECTED BY THE AUBURN RAVINE CITIZENS GROUP

PHYLUM			**12/01/00**			**10/01/01**		
Class			**Doty Ravine @ Garcia**			**Doty Ravine @ Garcia**		
Order								
Family			**A**	**B**	**C**	**A**	**B**	**C**
Genus species	**TV**[1]	**FFG**[2]						
ARTHROPODA								
Hexapoda								
Coleoptera (Larvae)								
Elmidae	5	cg				1		
Psephenidae	4	sc						
Diptera								
Chironomidae	6	cg	4	1	4	30	19	17
Empididae	6	p	4	3		3		
Simuliidae	6	cf	1	6	2	1	5	2
Tipulidae	3	sh						
Ephemeroptera								
Baetidae	4	cg	9	19	14	12	28	24
Ephemerellidae	1	cg	1					
Leptohyphidae	4	cg	19	14	29	5	5	11
Plecoptera								
Capniidae	1	sh		2	1			
Chloroperlidae	1	p	2	7				
Perlodidae	2	p	5	9	3	1		2
Trichoptera								
Brachycentridae	1	ot				1		
Glossosomatidae	0	sc	3	4	4		1	1
Hydropsychidae	4	cf	22	17	17		2	
Hydroptilidae	4	ot				3	6	1
Leptoceridae	4	ot						
Philopotamidae	3	cf					1	1
Lepidostoma								
Pyralidae	5	sc	2					
Odonata								
Coenagrionidae	9	p						
Gomphidae	4	p	2	5	3	3	5	3
Libellulidae	9	p	2	3	7	1	3	
Subphylum Chelicerata								
Arachnoidea								
Hydracarina (=Acari)	5	p	1	1		3		2
Subphylum Crustacea								
Malacostraca								
Amphipoda	4	cg	4	1	6	3	2	2

MOLLUSCA								
Gastropoda								
Limnophila								
Planorbidae	6	sc				3	3	
Bivalvia								
Pelecypoda								
Corbiculacea	10	cf					3	2
NEMATODA	5	p		1		2	1	1
NEMERTEA			11	5		4		2
PLATYHELMINTHES								
Turbellaria								
Tricladida								
Planariidae	4	p						
ANNELIDA								
Oligochaeta	5	cg	1	6	4	10	15	17
		Total Macroinvertebrates:	**93**	**104**	**94**	**86**	**99**	**88**
[1] **TV: Tolerance Values**								
[2] **FFG: Fuctional Feeding Groups**								
Taxonomic Richness			17	17	12	17	15	15
EPT Taxa			7	7	6	5	6	6
Ephemeroptera Taxa			3	2	2	2	2	2
Plecoptera Taxa			2	3	2	1	0	1
Trichoptera Taxa			2	2	2	2	4	3
EPT Index			66	69	72	26	43	45
Sensitive EPT Index			12	21	9	2	2	5
Tolerance Value			3.5	3.6	4.3	4.9	5.0	4.6
Percent Intolerant Organisms			12	21	9	2	2	5
Percent Tolerant Organisms			2.2	2.9	7.4	1.2	6.1	2.3
Percent Dominant Taxon			24	18	31	35	28	27
Percent Collectors			41	39	61	71	70	81
Percent Filterers			25	22	20	1	11	6
Percent Grazers			5	4	4	3	4	1
Percent Predators			17	28	14	15	9	9
Percent Shredders			0	2	1	0	0	0
Other			0	0	0	5	6	1

PHYLUM						12/01/00			10/01/01		
	Class					**Doty Ravine @**			**Doty Ravine @**		
		Order				**Garcia**			**Garcia**		
			Family		***Site Code:***	**A**	**B**	**C**	**A**	**B**	**C**
				TV[1]	**FFG**[2]						
ARTHROPODA											
	Hexapoda										
		Coleoptera (Larvae)									
			Elmidae	5	cg				1		
			Psephenidae	4	sc						
		Diptera									
			Chironomidae	6	cg	4	1	4	30	19	17
			Empididae	6	p	4	3		3		
			Simuliidae	6	cf	1	6	2	1	5	2
			Tipulidae	3	sh						
		Ephemeroptera									
			Baetidae	4	cg	9	19	14	12	28	24
			Ephemerellidae	1	cg	1					
			Leptohyphidae	4	cg	19	14	29	5	5	11
		Plecoptera									
			Capniidae	1	sh		2	1			
			Chloroperlidae	1	p	2	7				
			Perlodidae	2	p	5	9	3	1		2
		Trichoptera									
			Brachycentridae	1	ot				1		
			Glossosomatidae	0	sc	3	4	4		1	1
			Hydropsychidae	4	cf	22	17	17		2	
			Hydroptilidae	4	ot				3	6	1
			Leptoceridae	4	ot						
			Philopotamidae	3	cf					1	1
		Lepidostoma									
			Pyralidae	5	sc	2					
		Odonata									
			Coenagrionidae	9	p						
			Gomphidae	4	p	2	5	3	3	5	3
			Libellulidae	9	p	2	3	7	1	3	
Subphylum Chelicerata											
	Arachnoidea										
		Hydracarina (=Acari)		5	p	1	1		3		2
Subphylum Crustacea											
	Malacostraca										

		Amphipoda		4	cg	4	1	6	3	2	2
MOLLUSCA											
	Gastropoda										
		Limnophila									
			Planorbidae	6	sc				3	3	
	Bivalvia										
		Pelecypoda									
			Corbiculacea	10	cf					3	2
NEMATODA				5	p		1		2	1	1
NEMERTEA						11	5		4		2
PLATYHELMINTHES											
	Turbellaria										
		Tricladida									
			Planariidae	4	p						
ANNELIDA											
	Oligochaeta			5	cg	1	6	4	10	15	17
					Total	**93**	**104**	**94**	**86**	**99**	**88**

[1] **TV: Tolerance Values**

[2] **FFG: Functional Feeding Groups**

	12/01/00			10/01/01		
	Doty Ravine @ Garcia			Doty Ravine @ Garcia		
	Mean	**SE**	**CST**	**Mean**	**SE**	**CST**
Taxonomic Richness	15	1.7	19	16	0.7	21
EPT Taxa	7	0.3	8	6	0.3	8
Ephemeroptera Taxa	2	0.3	3	2	0.0	2
Plecoptera Taxa	2	0.3	3	1	0.3	1
Trichoptera Taxa	2	0.0	2	3	0.6	5
EPT Index (%)	69	2.0	69	38	6.3	38
Sensitive EPT Index (%)	14	3.8	14	3	0.8	3
Dominant Taxon (%)	24	3.6	21	30	2.4	24
Tolerance Value	3.8	0.2	3.8	4.8	0.1	4.8
Intolerant Organisms (%)	14	3.8	14	3	0.8	3
Tolerant Organisms (%)	4.2	1.7	4.1	3.2	1.5	3.3
Collectors (%)	47	6.8	47	74	3.5	74
Filterers (%)	22	1.3	22	6	2.9	6
Grazers (%)	4	0.5	4	3	0.9	3
Predators (%)	20	4.2	20	11	2.0	11
Shredders (%)	1	0.6	1	0	0.0	0
Other (%)	0	0.0	0	4	1.5	4
* Site statistics based on small and variable sample sizes						

	12/01/00			10/01/01		
	Doty Ravine @ Garcia			Doty Ravine @ Garcia		
	DRG-A	DRG-B	DRG-C	DRG-A	DRG-B	DRG-C
Taxonomic Richness	17	17	12	17	15	15
EPT Taxa	7	7	6	5	6	6
Ephemeroptera Taxa	3	2	2	2	2	2
Plecoptera Taxa	2	3	2	1	0	1
Trichoptera Taxa	2	2	2	2	4	3
EPT Index (%)	66	69	72	26	43	45
Sensitive EPT Index (%)	12	21	9	2	2	5
Dominant Taxon (%)	24	18	31	35	28	27
Tolerance Value	3.5	3.6	4.3	4.9	5.0	4.6
Intolerant Organisms (%)	12	21	9	2	2	5
Tolerant Organisms (%)	2.2	2.9	7.4	1.2	6.1	2.3
Collectors (%)	41	39	61	71	70	81
Filterers (%)	25	22	20	1	11	6
Grazers (%)	5	4	4	3	4	1
Predators (%)	17	28	14	15	9	9
Shredders (%)	0	2	1	0	0	0
Other (%)	0	0	0	5	6	1
*** Sample size less than 50 organisms**						